A NEW SPECIES OF ORTHOPTERA, FORMING A NEW GENUS AND FAMILY.

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While collecting on Sulphur Mountain, Banff, Alberta, on June 29th, 1913, Mr. T. B. Kurata and the writer captured two specimens of a peculiar wingless thysanuriform insect, which at once struck me as very remarkable on account of their possessing an ovipositor like that of the Tettigonidæ (Locustidæ). The two specimens, both females, are of about the same size, and, judging by the size and appearance of the ovipositor, are probably mature. They were found running about like centipedes under the stones of a talus-slope at an altitude of about 6500 feet. Considerable search was made for more specimens, but without success.

A study of these specimens shows that they are genuine Orthoptera, but of a very generalized type and cannot be placed in any of the known families of this order. Their appearance is somewhat suggestive of the termites, or, still more, of the nymphs of the Plecoptera, but that they are true Orthoptera is at once apparent, in spite of the total absence of wings, on an examination of the mouth-parts, the cervical and thoracic sclerites and the ovipositor.

This insect forms the type species of a new genus, *Grylloblatta*, and a new family, *Grylloblattidæ*.

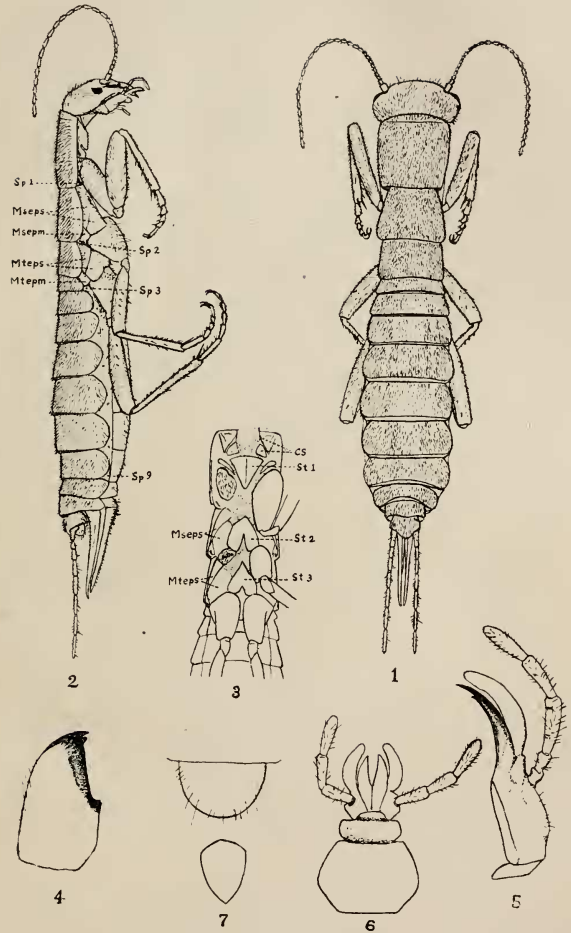
Grylloblattidæ, new family, and **Grylloblatta,** new genus.

Body elongate, slender, depressed, thysanuriform; head blattoid, somewhat flattened, obliquely attached to the prothorax; epicranial suture distinct; antennæ arising close to the fronto-clypeal suture, shorter than the body, with 26 to 29 segments; eyes small, widely separate; ocelli absent; labium with glossæ and paraglossæ separate and well differentiated. Thoracic nota flattened, quadrate, decreasing in size caudad; meso- and meta-episterna well developed, oblique, each with a horizontal fold, apparently dividing it into two parts; epimera small; sternal plates small, separated by considerable areas of soft cuticle; thoracic stigmata two, the first close to the hind margin of the prothorax, the second upon the mesepimeron. Legs cursorial; coxæ large, especially the first pair; femora, tibiæ and tarsi with a few slender scattered spines, tibial spurs two, an outer

and inner, the latter the larger; tarsi 5-jointed, without pulvilli. Abdomen with 10 segments; tergites not overlapping the sternites, separated by a well-developed pleural membrane; abdominal stigmata on the pleural membrane of segments 1–7, very minute and difficult to see; cerci about as long as the hind tibiæ, slender, cylindrical, 8-jointed; ovipositor exserted, composed of 3 pairs of elongated processes or valves, the upper pair slightly longer, the middle pair slightly shorter than the lower pair; inner valves exposed in lateral view, each valve fitting into a groove on the corresponding valve of the lower pair, but not connected with the upper pair.

Grylloblatta campodeiformis, n. sp.

Body uniform honey-yellow, covered with minute pubescence. Head flattened, rounded, nearly as broad as long, broadest across the eyes, which are ovo-triangular, about as broad as long and distant from the lateral margin by a little less than their transverse diameter; facets about 70, slightly irregular in size and arrangement; antennæ reaching back to about the hind margin of the metathorax, filiform, very slightly tapering; first segment somewhat flattened, about two-thirds as wide as the eye and as long as segs. 2–3, which are together equal to segs. 4,5 and 6, distad of which the segments gradually increase in length to about seg. 16, shortening again slightly towards the apices; clypeus as broad as the space between the middle of the basal joints of the antennæ and somewhat more than twice as broad as long, lower margin nearly straight; labrum semi-ovate, the free margin regularly convexly curved; mandibles with a basal, apical and subapical tooth (maxillæ and labium, see pl. VI, figs. 5, 6). Pronotum transversely feebly convex, slightly longer than broad, anterior margin gently arcuate, posterior margin nearly straight and subparallel, antero-lateral angles slightly rounded, postero-lateral angles rectangulate; a straight transverse groove just behind the anterior margin. Mesonotum scarcely three-fourths as long as the pronotum, somewhat constricted at base, expanding slightly caudad, the straight posterior margin somewhat greater than the length, the lateral margins deflected, arcuate in lateral view; postero-lateral angles well rounded. Metanotum almost four-fifths as long as the mesonotum, somewhat less than twice as broad as long, feebly expanding



GRYLLOBLATTA CAMPODEIFORMIS, n. gen et. sp.

caudad; lateral margins and postero-lateral angles as in the meson-otum. Prosternal plate triangular, mesosternal and metasternal plates somewhat V-shaped, all separated by considerable areas of soft integument, which is covered by the large coxæ. Front coxæ stout, slightly shorter than the pronotum and longer than the middle and hind coxæ, the middle pair being the shortest; each coxa with a distinct ridge separating the ventro-anterior and postero-lateral surfaces. Fore and middle femora and tibiæ all of nearly the same length, each being about as long as the pronotum; front tarsi slightly shorter, middle tarsi slightly longer than the corresponding tibiæ; hind femora, tibiæ and tarsi of nearly the same length, distinctly longer than the corresponding parts of the other two pairs of legs. Abdomen widening from base to segment 5, which is slightly wider than the head, narrowing again rapidly in the last 3 segments. Cerci with 8 cylindrical segments, which gradually lengthen distad. Ovipositor slightly shorter than the hind femora, somewhat compressed, in profile tapering rapidly from the base, the basal depth being about one-third of the length; upper valves nearly straight, lower and inner valves distally up-curved, apices of all acute.

MEASUREMENTS (lengths in millimetres).

	Body ex. ov.	Ant-enn.	1st fem.	1st tib.	1st tar.	2nd fem.	2nd tib.	2nd tar.	3rd fem.	3rd tib.	3rd tar.	Ovip.
Type	30	8.5	2.8	2.25	2.6	2.5	2.5	2.75	3.4	3.6	3.4	3.0
Cotype	30	9.0	2.6	2.25	2.6	2.5	2.3	3.0	3.2	3.5	3.4	3.3

Type ♀ and cotype ♀: Sulphur Mt., Banff, Alta., 6500 ft., June 29th, 1913, in the collection of the University of Toronto.

The family Grylloblattidæ differs from all the other families of non-saltatorial Orthoptera in the possession of a large exserted ovipositor of the Tettigonid type. Among other differential characters possessed by these families are the following:

In the Hemimeridæ the tarsi are 3-jointed, the coxæ small and widely separated, the cerci unjointed, and the abdominal sternites are overlapped by the tergites.

In the Blattidæ, the general form of the body is much broader, the head is scarcely visible from above and is much narrower than the pronotum, which is usually broader than long; the antennæ are longer than the head and thorax, setaceous and generally consist of

a larger number of small segments; the cerci are flattened and distally tapering.

In the Mantidæ, the eyes are larger and much more prominent, the antennæ setaceous, the front legs raptatorial and the front femora nearly always spinose along the outer edge; the prothorax is usually elongated and the cerci are much shorter than the hind femora.

In the Phasmidæ the prothorax is smaller than the mesothorax, the meso- and metathorax are both greatly elongated, the coxæ small and short, pulvilli are present and the cerci are unsegmented and shorter than the hind femora.

From the families of saltatorial Orthoptera the Grylloblattidæ differ in the generalized structure of the hind legs, the five-jointed tarsi and the jointed cerci.

Gryllobatta is thus seen to combine characters possessed by several different Orthopterous families, but to be amply distinct from all of them. On the whole, it appears to be most nearly related to the Blattidæ, though the general form of the body is most like that of the Forficulidæ. It resembles the Blattidæ very closely in the form of the head, the depressed body and cursorial legs, but the form of the body is less specialized and the peculiarities of the blattid leg, such as the greatly enlarged and closely approximated coxæ with the correlated reduction of the sternal plates, though present in Grylloblatta, are much less marked than in the cockroaches. The scattered tibial spines and five-jointed tarsi are also characters that are common to both families. The simple antenniform cerci recall those of *Campodea*, and are probably of a more primitive type than the short flattened cerci of the Blattids.

The position of the base of the antennæ close to the fronto-clypeal margin is another primitive character in which *Gryllo-blatta* resembles the Plecoptera.

On the other hand, *Grylloblatta* appears to be more specialized than the Blattidæ in the absence of styli and the presence of the Tettigonid type of ovipositor. Apart from these latter features this genus is distinctly more primitive than any of the other families of Orthoptera, as far as external features are concerned.

Of the three families of saltatorial Orthoptera, *Grylloblatta* is most like the Gryllidæ in the depressed form of the body and shape

of the head, but resembles the Tettigonidæ much more closely in the structure of the ovipositor the inner valves of which, as in this family, are nearly as long as the other two pairs. The antennæ, however, in length and in number, size and form of the segments are most like those of the Locustidæ (Acrididæ).

The presence of the Tettigonid type of ovipositor in so primitive a form as *Grylloblatta* seems to indicate that this type of ovipositor was present in the earliest saltatorial Orthoptera and that the Tettigonidæ are therefore, in this respect, the most primitive of the modern saltatorial families.

If this conclusion is not accepted, then one at least of the following assumptions must be made:

(a) That *Grylloblatta* is a degenerate descendant of saltatorial forms, which, like the mole-cricket, has secondarily lost its power of leaping.

(b) That the adaptations for leaping have been independently acquired in the Tettigonidæ on the one hand, and the other families of saltatorial Orthoptera on the other, i.e., *Grylloblatta* and the Tettigonidæ represent a distinct line of descent from those which have culminated in the Gryllidæ and Locustidæ.

(c) That the resemblance between the ovipositors of the Tettigonidæ and *Grylloblatta* is due to convergence.

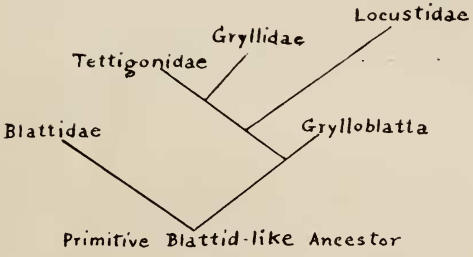
The first assumption is clearly untenable on account of the evident relationship between the Grylloblattidæ and the other non-saltatorial Orthoptera, particularly the Blattidæ, with which they share the 5-jointed tarsi and jointed cerci, both of these being primitive characters not present in any of the saltatorial Orthoptera.

The second assumption is equally inadmissible, as the families of saltatorial Orthoptera form a decidedly natural group, the Gryllidæ and Tettigonidæ being particularly closely allied to one another.

The third assumption is less improbable, but the resemblance between the ovipositors of *Grylloblatta* and the Tettigonidæ is very close, and it seems more natural to regard them as truly related in this respect.

I am thus inclined to regard the ovipositor of *Grylloblatta* as nearly representing that of the common ancestor of the three families of saltatorial Orthoptera, the Tettigonidæ having departed least from the original type as regards this structure. *Grylloblatta* has been derived from some primitive type of Blattid or Blattid-like ancestor.

These relationships are expressed graphically in the accompanying diagram.



EXPLANATION OF PLATE VI.

Fig. 1. *Grylloblatta campodeiformis*, ♀ type, dorsal view.

Fig. 2. Same, lateral view.

Fig. 3. Same, ventral view of thorax and base of abdomen (front and middle legs of right side removed).

Fig. 4. Same, mandible.

Fig. 5. Same, maxilla.

Fig. 6. Same, labium.

Fig. 7. Same, labium (above), hypopharynx (below).

Sp.1, Sp.2, Sp.3, Sp.9, Spiracles; Mseps mesepisternum; Msepm, mesepimeron; mteps, metepisternum, mtepm, metepimeron, C. S., cervical sclerites; St1, St2, St3, pro-, meso- and metasterna.